### Example Problems Packet

## Mix Design & Production Control Recertification

Quality Control / Quality Assurance



# DOT-86 Equations

Gmm = maximum specific gravity of paving mix

Gsb = bulk specific gravity of mineral aggregate

specific gravity of asphalt binder eq9

Gmb = bulk specific gravity of compacted mix

percent asphalt binder content Pb =

height<sub>(measured)</sub> % hydrated lime ප ප  $\times 100$ Ps  $\times 100$ Ps <u>원</u> GSb GSb Gsb × Ъ Ъ Gmb 100 × Va) Gmb Pba % -- #200 material + × Pbe × Gmm VMA 100 Gse 100 Gse 100 Gmm Gmb<sub>(measured)</sub> VMA Gmm Pb – 100  $100 \times$ Ш Ш Ш Ш Ш Ш Ш Ш Ш **Dust to Binder Ratio** (Voids in the Mineral Aggregate) (Percent aggregate content of (Percent asphalt absorption) (Effective specific gravity of (Voids Filled with Asphalt) (Percent effective asphalt mineral aggregate) (Percent Air Voids) VMA content) Gse mixture) VFA Pbe Pba **S** S

height x Gmb x

Calculation for  $G_{ab}$  bulk specific gravity of compacted mix at any given gyration point in the compaction process when x is number of gyrations such as at  $N_{ac}$  or  $N_{dec}$ 

(Percent of mixture theoretical maximum specific gravity) % of Gmm

Ш

$$\left(\frac{\rm Gmb}{\rm Gmm}\right)\times 100$$

#### Problem #1

Flat & Elongated (SD 212)

Given the following gradation, calculate the percent of flat and elongated particles.

Gradation					
Sieve	Retained (g)				
Size	ixetailled (g)				
3/4"	0.0				
5/8"	0.0				
1/2"	227.8				
3/8"	696.9				
1/4"	1219.8				
#4	922.8				

	Α	В	С	D	E
Sieve Size	Total Sample Weight on Sieve	Weight of Tested Portion (100 pieces)	Weight of Flat/Elongated Particles	% Flat/Elongated (Individual Sieve)	% Flat/Elongated Weighted Average
3/4" to 1/2"		227.8	5.0		
1/2" to 3/8"		222.2	7.3		
3/8" to #4		61.1	3.0		
Total Sample Wt.		F			

Percent flat and elongated particles in the total sample (weighted average)

rounded	

#### Problem #2

#### Given:

- Q2R mix with 20% RAP to be added by weight of aggregate
- Solvent extraction test result of 6.50% binder in RAP
- 1.00% hydrated lime added by weight of total mix
- Aggregate bin splits
  - 30% Rock
  - 25% Crushed Fines
  - 30% Natural Fines
  - 15% Sand
- a) Prepare a 4750 gram batch with 4.5% added new binder by weight of total mix.
- b) Determine amount of added new binder, lime, RAP, rock, crushed fines, natural fines and sand to be added for a gyratory specimen.
- c) Also determine total binder, new(added) and old (RAP).

#### Problem #3

DOT-86 Gyratory Worksheet

Complete the DOT-86 for a Q3R Mix.

Use the equation sheet in the Problems Packet.

Mix Temp	275							
				No. of gyrations				
% binder Pb	6.0		N initial			Gse		
Gsb	2.554		N design			Pba		
binder Gb	1.024		N max			Pbe		
dust (- #200)	4.69				•			•
lime	1.00	Spec. A (Ndes)		Spec. B (Ndes)				
dust(-#200) + lime		@ N ini	@ N des	@ N ini	@ N des	@ N ini	@ N des	@ N max
a) Height, mm		122.6	114.5	124.7	116.3	124.7	116.1	114.9
b) Weight in air			4697.7	]	4698.9	]		4696.8
c) Weight in water	er		2667.0		2668.2			2687.3
d) SSD Weight			4699.2		4700.4			4697.4
e) Gmb (measure	ed) b/(d-c	)						
f) Gmb (calculat	ed)							
			Gmm #1		Gmm #2	-		
			45454	1	45040	1		

	Gmm #1		Gmm #2
Weight of sample in air	1545.1		1534.2
Weight of canister + H <sub>2</sub> O	1365.4		1365.4
Weight of canister + H <sub>2</sub> O + sample	2271.5		2264.1
Temperature of water	77.0		78.0
H₂O correction factor	1.0000		0.9999
Rice SpGr (Gmm)			
Average Max SpGr	]		
	N initial	N design	N maximum

	N initial	N design	N maximum
Average Gmb			
% of Rice SpGr (Gmm)			

_			Dust to	
% Air Voids (Va)	% VMA	% VFA	Binder Ratio	
Specs:				

Dust to